IJBCS
ISSN: 2147-1428

Review Article
International Journal of Basic and Clinical Studies (IJBCS)
2017; 6(2): 5-13 Gungor-Ordueri NE et al.

From Natural Selection To Smart Selection

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Abstract

The sources are limited in nature; organisms with heritable traits that favor survival and reproduction will tend to leave more offspring than their peers, causing the traits to increase in frequency over generations. Thus there is natural selection. In decades, we try to figure out how to find new sources or can we adept some different capabilities together just in one organism. Although there is a genetic selection under different situations, the evolution and selection will change likely due to falling mortality rates in recent life.

Synthetic biology and biotechnology have been in our lives for decades regarding day work, basic needs, and scientific development. This technology contributes to nearly every single industry from agricultural to energy, medical to forensic. In this review, we aim to explain how far we are to the bionic and cyborg technology, which evaluate from E.coli to plants, mammoths, sharks and finally to human beings. We suggest that, we can use some bionic attachments to maintain our lives even to see or hear. And we have the capability to combine the clues of the environment like biofuels by using the new technology for making the smart selection.

Keywords: Biofuels, prostheses, nature dynamics, biotechnology

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Introduction

We used two words these days; one is Bionic and the second one is Cyborg, which, both came into usage around the same time in 1960s (Manfred E., Cyborg and space) Where as "bionic" borrows the "bi-" from *bi*ology and "-onic" from electr*onic*, "cyborg" is a combination

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of *cy*bernetic and *org*anism. Both refer to living organisms that are aided or enhanced by artificial means.

As we know from the environment and developmental biology process, there are some similar capabilities we have with animal, plants and bacteria.

After we used those capabilities by using biotechnology in a new world, the life and the environment has been started to change **(Figure 1.)**

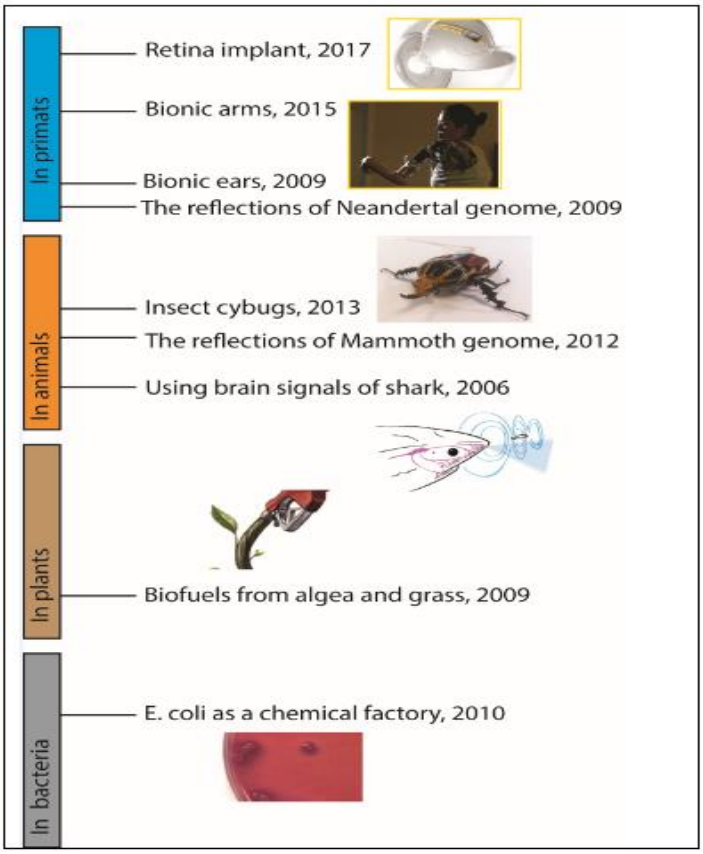

Figure 1. By using different species, there is a timeline for smart selection. We categorized some new biotechnological results by dates from bacteria to primates.

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https://www.scientificamerican.com/article/bacteria-transformed-into-biofuel-refineries/

In Primats

Bionic ears, vestibular prostheses

The vestibular system is a sensory system that is critically important in humans for gaze and image stability as well as postural control. Patients with complete bilateral vestibular loss are severely disabled and experience a poor quality of life. There are very few effective treatment options for patients with no vestibular function. Over the last 10 years, rapid progress has been made in developing artificial 'vestibular implants' or 'prostheses', based on cochlear implant technology. As of 2017, 13 patients worldwide have received vestibular implants and the results are encouraging. Vestibular implants are now becoming part of an increasing effort to develop artificial, bionic sensory systems, and this paper provides a review of the progress in this area (1) .

Retina implant

Researchers confirmed that the initial efficacy results of the Retina Implant Alpha AMS (Retina Implant AG, Reutlingen, Germany) for partial restoration of vision in end-stage retinitis pigmentosa (RP) by comprising residual vision with the retinal implant switched ON versus OFF in the implanted eye (2). They measured the participant's improvement in activities of daily living, recognition tasks, and assessments of light perception with the implant ON compared with OFF. All 6 participants underwent successful implantation. Light perception and temporal resolution with the implant ON were achieved in all participants. The Alpha AMS subretinal implant improved visual performance in 5 of 6 participants and has exhibited ongoing function for up to 24 months.

Robotic arms

The foundation of surgical robotics is in the development of the robotic arm. They have reviewed the published literature and classified robotic arms by their application: show, industrial application, medical application, etc. There is a definite trend in the manufacture of robotic arms toward more dextrous devices, more degrees-of-freedom, and capabilities beyond the human arm (3). In 2000 Miguel Nicolalis redefined possible man-machine capacity in his work on cerebral implantation in owl-monkeys directly interfacing with robotic arms both locally and at a distance (4). Ongoing work in robotics has many potential solutions to the drawbacks of current robotic surgical systems.

In Animals

Getting the information from the frozen Mammoths

In the last few decades, Ancient DNA's are started to reveal important aspects of common strands of DNA's in different organisms all around the world. According to the archeologists, Bone remnants of mammoths that went extinct 4,000 years ago were found in Siberia (5). Siberia's weather conditions preserved the DNA in the bones from disappearing completely, which provided the opportunity to sequence

the mammoth genome. With the obtained mammoth genes, a group of studies held on to find a way for reviving the mammoths. Researches, transferred wooly mammoth genes to the genome of an Asian elephant. Then, the genes that were missing in the elephants were distinguished by examining the DNA specimens in order to find the differences between the wooly mammoth and the elephant. Church and his team reconstructed 14 genes with the CRISPR method (6). These scientists tied the mammoth's small ears, subcutaneous fats and hair lengths and colors to the DNA of the elephant's skin cells. Thus, it was shown that wooly mammoth genes, which had been extinct in tissue culture years ago, are still functional (7).

Sharks as a host

With advances in brain-machine interfaces, neural engineering, and artificial intelligence, bio robots are becoming more and more attractive. A bio robot uses an animal as a host and controls the host via neural interfaces (8). They are expected to be superior to traditional mechanical robots in mobility, perceptivity, adaptability, and energy consumption (9). Within the past two decades, bio-robots have been realized on different kinds of creatures, such as cockroaches, moths, beetles, rats and sharks (10).

The DARPA (Defense Advanced Research Project Agency), which made significant investments in breakthrough technologies for national security, began to work to control the movement of its shark. The engineers have created neural implants to remotely control the brain signals of the shark (11).

In Plants

Antifreze proteins for potato

Hard conditions have been constantly a complication in agriculture in order to grow plants. With this technology, scientists have endeavored to overcome this issue. One of the successful approaches of agricultural biotechnology was published in early 1997. According to the article, a study on antifreeze protein in potato to substantially eliminate freezing at low temperatures (12), cold and frost damage plants by some mechanisms. As the temperature decreases, ice formation begins, especially in the cytoplasm, which eventually causes cell death. Shrinkage of the cytoplasm leads cells to desiccation and damaged cells releases electrolytes. However, plants have improved several defense mechanisms against harsh conditions. Anti-freeze proteins (AFPs) play a large part in inhibition of ice growth and recrystallization. AFPs have been found in winter flounder, shorthorn sculpin, and other overwintering organisms. The idea of the expression of a Type I AFP in plants directed the study to cloning and expression of AFP gene in a potato via fusing the gene with the signal sequence of phytohemaglutinin (PHA) to obtain endurance against cold. Cloning was conducted by using Agrobacterium tumefaciens, a bacteria

used for transformation in plants, for transformation, a process that enables bacteria to take foreign DNA from the environment. The AFP gene was interfused by PHA signal sequence; using specific restriction cites special sequences that enable enzymes to cut the DNA. As for the introduction of AFP-PHA into plants, AFP-PHA cloned plant transformation vector was used. Component plant cells were recognized by PCR screening and protein of interest by western blot. After transformation, selected sprouts were located in soil with favorable growth conditions (13)

Fuels from Algae

Energy consumption has been significantly increased over the decades, especially increased demand on fossil fuels creates an urgent need for alternative energy sources since only %10 of energy production is from renewable sources while %90 is from fossil fuels that are limited and predicted to be vanished after 2050 (14) Biofuels are the new approach to renewable energy which includes the theory of providing fuels made from biomass such as agricultural waste and wood (15). Production of biofuels is simply divided into 2 types; on one hand, alcohol that is fermented from biologically derived materials; on the other hand, natural oils that will transform into biodiesel (16). However, as a next-generation biofuels, using microorganism that rapidly grows for providing fuel via only carbon dioxide and sunlight seems to be suitable universal solution (17). Algae have a great potential source of next-generation biofuels (18), which is a single-celled organism that is considered as one of the lowest life-forms that has the ability to convert sunlight into energy via photosynthesis (19). According to an article (14), the reason of this advantage is that as a photosynthetic organism, algae can fix CO_2 with efficiently captured solar energy 10-50 times greater than terrestrial plants. In order to convert the captured CO_2 into bicarbonates and store as lipids carbohydrates and proteins, extracellular zinc metalloenzyme carbonic anhydrase (CA) is used as a catalyzer by algae. After the process, stored lipids in algae/microalgae are extracted and used as a biofuel, which is materialized by upstream and downstream phases.

Fuels from grass

Most biofuels in use currently were derived from food crops before the time of next-generation biofuels, many types of research seek out for candidate biomass crops which do not directly compete with food crops and can be grown on marginal lands (20). Many of these candidates are C4 grasses, which have high productivity and efficient resource use. C4 stands for photosynthetic pathways that, where Rubisco oxygenase activity is reduced due to the concentration of CO2 and enhanced CO2 mechanism that involves phosphoenolpyruvate (PEP) carboxylase which results in a higher potential efficiency of converting solar energy to biomass (21). C4 plants, such

as switchgrass, is chosen for extensive root systems and the ability to store nutrient and carbohydrate lignocellulose feedstock which is combined with bioenergy dedicated cropping systems leads to obtaining a renewable supply of cellulosic biofuel (22).

In Bacteria

Escherichia Coli as a biological factory

Escherichia coli (E. coli) is a gram negative, facultative anaerobe non-spore forming bacteria, located in the gut microbiota and in the produced feces of humans. In humans E. coli produces supplementary nutrition and preventing the formation of bacteria, which can be pathogenic (23, 24). However, E. coli is also responsible for most cases of food poisoning (25). In biotechnological field of molecular biology, E. coli's are the most valuable living organism due to their capacity to colonization and manipulation in both *in vivo* and *ex vivo* studies (26). As it started form the late 20th century, E. coli started to be manipulated for using them as a biological factory to produce proteins, medicine and the most recent is, Fuels. In 1979, the scientists had successfully manipulated the E. coli to produce insulin, which nowadays provides the almost all insulin drugs, which can be obtained from pharmacy. Normally, human insulin is produced in the beta cells of pancreatic islets and it is responsible for glucose metabolism. Insulin is composed of two different chains, the A chain (which is 21 amino acid) and the B chain (which is 30 amino acid). To produce insulin synthetically the two chains must be first produced separately, then must be purified and combined again to make fully functional insulin. For this process, first E. coli's are manufactured with a small circular DNA, plasmid, which in this process with pBR322. Then, insulin-producing genes were inserted into this plasmid and reintroduced to E. coli. After E. coli's produce each protein separately, these two amino acid chains of insulin are recombined for medical uses (27).

These highly productive E. coli's are not only used in medicine, but also in environmental issues, such as fuels. The fuels produced by E. coli are referred as biofuels and it is the most recent success in the field of synthetic biology (25). First of all, to synthesize biofuels, the bacteria must produce chemicals such as alcohol and cyclic isoprenoids. The specific genes related with the production of these chemicals are integrated right after the inducible promoters in the bacteria. Usually these genes (such as lux gene) are related with the quorum sensing, a system for communication between each bacteria about the population and triggers gene expression where it is necessary. This system has applied into different biosynthesis pathways, such as production in shikimate, isopropanol and glucaric acid in E. coli. However, recent studies have shown that E. coli can be manipulated to produce bisabolene, which is a precursor for biosynthetic alternative of No. 2 diesel fuel. In the process of manipulating E. coli for production of bisabolene, first of all lux genes are ligated with the pBbS0a plasmid, which have an ampicillin resistant gene and a SC101

replication origin. Then, genes related with the production of farnesyl pyrophosphate are introduced to the plasmid (28). With these knowledge used in manipulating E. coli, scientists can force E. coli to produce nearly any kind of chemical, which then can be used in variety of research fields.

Discussion

After learning about the genome of the Neanderthal (29), who are the most recent archaic humans, who emerged between 300,000 and 100,000 years ago and were replaced by early modern humans between 35,000 and perhaps 24,000 years ago, we realized that we are not the latest species of primates in the world.

By this review we study on the relation between some primates, animals, plants and bacteria together to find out how to use bionical materials beside their both genetic and technological capabilities to use in different fields for giving healthy and useful life for human.

We have mentioned that several cortical devices are being developed, for which first-in-human trials may be conducted in the near future (30). In this paper, we propose a new methodology for the detection of multiple biological therapies, which is to be applied in parallel.

We have known that up to recent days, studies have shown by transferring the genes of an extinct creature to a living one the species can be aroused. For an example, if everything continues as expected, the mammoth-elephant mixture embryo is awaited to grow in an artificial uterus (7). Another alternative is to be given birth by a female elephant besides some ethical problems. Even if mammoths are brought back, there are some questions, can they adapt to these conditions? Or how will it affect the ecosystem? On the other hand, while attempting to create a woolly mammoth, the elephant genes can be replaced with mammoth genes, which will give them a feature of mammoth and can make them more resistant to cold. However, there is still a long way to go. If these studies will be successful, then it will bring up many new research topics and new questions that needs to be answered.

Manipulating sharks is another field which can have promising results. Due to shark's ability of sensing the magnetic field, they can be controlled with a device implanted to the brain of a shark. The implant consists of multi-channel neural ensemble readers and stimulators, diverse controllers and sensors. Thus, the movements of the sharks can be controlled and their perceptions possibly decode. If these experiments succeed, in the future sharks could be trained to track enemy ships or submarines, or to detect underwater mines or cables

Another promising organism, which are used for production of fuel and for manipulating them to be more resistant to weather conditions, is plants. To make potatoes more resistant against cold, some cold resistant genes, such as AFP genes, are transferred into plasmid, then introduced into plant cells. We suggest that this unique AFP

gene could be a new breath in order to protect plants, anima or even human beings in those times of scarcity during frost or the frost itself. In the future, AFP gene could be used in cryopreservation, a use of very low temperatures to preserve intact living cells and tissues. Furthermore, grasses and algae's can also be programmed for making them produce biofuels, which can overcome the problems that the world faces, such as climate changes, consumption of fossil fuels etc. For further studies, grasses can be manipulated for become consumable and beneficial for human health, and algae's can be seeded into the cars, which will produce fuel for car in the favorable conditions.

In the bacterial perspective, E. coli, is a gram negative bacteria which is widely used for both *in vivo* and *in vitro* studies (31). Most recent experiments have shown that the E. coli's can be manipulated to produce variety type of chemicals, which can be used in different fields such as medicine and environmental (26).

Even though this field has come to a promising point, it needs to be studied more to understand how to force the E. coli's to produce new chemicals. In the future, it will be possible to not only use the chemicals produced by E. coli, but whole bacteria for curing diseases, manipulate them to use in forensic sciences or for producing type 0 blood from A, B or AB blood types. However, scientist must be certain for any unexpected conditions that can E. coli cause when they are introduced in human body.

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